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TAKING THE INITIATIVE – PROTECTING US INTERESTS IN SPACE

by

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BIOGRAPHY

Lieutenant Colonel Stephen E. Redifer (Bachelor of Aerospace Engineering, Auburn University; Master of Science in Applied Physics and Master of Science in Space Systems Operations, Naval Postgraduate School) is a student at the Air War College, Maxwell AFB, Alabama. LtCol Redifer graduated from Auburn University in 1990, receiving a commission as a Second Lieutenant, United States Marine Corps on 14 Dec 1990. Following graduation from The Basic School, he was ordered to 3d Tank Battalion, Twentynine Palms, CA where he served as a tank and AT(TOW) platoon commander and participated in a deployment to Mogadishu, Somalia in support of Operation Restore Hope.

From 1994 to 1997, LtCol Redifer was assigned to Marine Corps Security Force Company Yorktown where he served as Deputy Security Officer for Operations and as a security force platoon commander tasked with the providing security for assets critical to national security. LtCol Redifer then attended the Armor Officer Advanced Course at Ft. Knox, KY and after graduation was assigned to 2d Tank Battalion, 2d Marine Division, II Marine Expeditionary Force, Camp Lejeune, NC, where he served as a commanding officer, Company A and battalion logistics (S-4) officer.

LtCol Redifer attended the Naval Postgraduate School, Monterey, CA from 2002 to 2005 and, upon graduation, was assigned as the Joint Space Plans Officer, Information Operations and Space Integration Branch, Strategy and Plans Division, Plans, Polices, and Operations Department (PP&O), Headquarters, U. S. Marine Corps where he served until 2005.

Upon completion of his tour at HQMC, Lieutenant Colonel Redifer returned to 2d Tank Battalion in June 2005, where he served as the battalion operations (S-3) officer and executive

officer. Upon his promotion to Lieutenant Colonel, he was assigned as the 2d Marine Division G-3 Current Operations Officer and ultimately as the II MEF(Forward) Deputy Current Operations Officer, serving in the latter billet throughout II MEF(FWD)'s deployment to Iraq in support of Operation Iraqi Freedom 06-08.

Prior to assignment to the Air War College in 2010, Lieutenant Colonel Redifer was assigned to Marine Corps Embassy Security Group, Quantico, Virginia, where he served as the Commanding Officer, Region 8 (Central Europe), Marine Corps Embassy Security Group, Frankfurt, Germany.

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INTRODUCTION

The US dependence on space has continued to grow in military, intelligence, and commercial circles, and the market for space services has grown commensurate with this demand; the world community, to include both our allies and potential adversaries, has noted this dependence. Due to US interest in the services provided by satellites, various initiatives to protect space systems have been given significant attention over the past decade, but have lacked a consistent vision and have not always fared well when competing for limited budget resources. This paper will briefly discuss the threat posed to US space systems, review stakeholder equities, explore the schools of thought regarding defense of space assets, pose possible solutions, and culminate in a recommendation for a way ahead to protect US space equities.

The *2001 Report of the Commission to Assess United States National Security Space Management and Organization* stated that the United States is an attractive candidate for a "Space Pearl Harbor," and cited several vulnerabilities, to include satellite malfunctions, ground station equipment failures, hackers, and the threat posed by Chinese anti-satellite efforts.[1] Nine years later in 2010, the National Space Policy of the United States of America (NSP) reiterated several principles seen in the 2006 NSP, including one which states that the United States "will employ a variety of measures to help assure the use of space for all responsible parties, and … deter others from interference and attack."[2] While certainly an important goal, this is a complex and multi-faceted task with several hurdles impeding its realization, including assignment of a party responsible for space protection and surveillance, establishment of a US strategy for space

1. Hon. Donald H. Rumsfeld et al, *2001 Report of the Commission to Assess United States National Security Space Management and Organization* (Washington DC, 2001), 22.
2. Obama, Barack H., *National Space Policy of the United States of America* (The White House, Washington, DC, June 2010), 3.

control[3], and development of a comprehensive operational space picture that provides sufficient granularity to deter or respond to an attack. This challenge is exacerbated by the fact that any protection/surveillance schema will require the inclusion of a wide variety of agencies with disparate goals, missions, and cultures.

This issue is further compounded by the fact that any discussion regarding government/military responsibilities in space and space control strategy often centers on the pros and cons of the weaponization[4] of space or the US ability to "control" space and, as such, tends to focus on offensive action. This invariably results in a politically charged debate in which numerous camps advocate a variety of courses of action, ranging from those who desire a national policy of space dominance to those who would seek a sanctuary where space is not used for any military purpose[5]. Solutions encompass a variety of options, from the fielding of systems that would give the United States the ability to take pre-emptive action in space to developing treaties that would limit the legal right of the signatories to take any action that would harm space assets or the space environment. Although related, there is less discussion above the service level regarding the protection of space systems and the development of space situational awareness (SSA)[6], as these may be seen as US Strategic Command (USSTRATCOM) or US Air

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3. Space control is defined as operations to ensure freedom of action in space for the US and its allies and, when directed, deny an adversary freedom of action in space. (*Joint Publication (JP) 1-02, DoD Dictionary of Military and Associated Terms* (12 April 2001 (As Amended Through 30 September 2010)).

4. For the purposes of this paper, weaponization of space is defined as placing weapons in space that can attack and negate the capability of other space systems on orbit, can attack targets on earth, and/or space-based missile defense systems. Adapted from spacedebate.org, http://www.spacedebate.org/definition/Space%20Weapon/, (accessed 8 December 2010).

5. For the purposes of this paper, militarization of space is defined as the use of assets based in space to enhance the effectiveness of conventional forces, to include ISR, communication, missile warning, and positioning, navigation, and timing.

6. Joint Publication (JP) 3-14, *Space Operations*, 06 January 2009, II-7 describes space situational awareness as: "Characterizing, as completely as necessary, the space capabilities

Force (USAF) "problems." However, given the international reliance on space products for commerce, navigation, weapons employment, and so forth, this issue transcends the means and scope of one service or one combatant commander – in fact, it is of national concern. Within the Department of Defense, there exists a need and a responsibility to create a culture of understanding regarding the value of space systems and the importance of protecting them that transcends the responsibility of just the USAF or USSTRATCOM; all users must understand the situation in space in order to plan for the loss or degradation of space capabilities or to perhaps nominate the enemy's anti-satellite systems as high value targets. Additionally, in the same manner that a battlespace owner must consider force protection for air, sea, and land forces, there is also a possibility that space assets will need to be actively protected by a theater combatant commander(s). The commercial and civil space sectors must also understand that their space systems are at risk, which may have a detrimental effect on US national power. Finally, any potential solutions to protect US space systems will include a large number of stakeholders that crosscut the US government, commercial entities, and end users who rely on satellites for business as well as recreational use.

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operating within the terrestrial environment and the space domain. It includes components of ISR; environmental monitoring, analysis, and reporting; and warning functions. [Space situational awareness] leverages space surveillance, collection, and processing of space intelligence data; synthesis of the status of US and cooperative satellite systems; collection of US, allied, and coalition space readiness; and analysis of the space domain. It also incorporates the use of intelligence sources to provide insight into adversary use of space capabilities and their threats to our space capabilities while in turn contributing to the [joint force commander's] ability to understand enemy intent."

PROTECTION OF SPACE SYSTEMS – THE TASK, THE THREAT, AND THE STAKEHOLDERS

The prominent stakeholders tasked with protection of space systems and ensuring SSA are loosely identified in the NSP, as it tasks all US Government departments and agencies to "[d]evelop, maintain, and use space situational awareness information from commercial, civil, and national security sources"; additionally, the Secretary of Defense and the Director of National Intelligence have been directed to "ensure [the] cost-effective survivability of space capabilities."[7] While clearly stating the goal, what is less clear is who will have responsibility for its implementation and what authority this person or agency will have to ensure compliance by other stakeholders, to include the commercial sector.[8]

The execution of such tasks will undoubtedly be extraordinarily difficult given the global nature of space, the increasing commercialization of space, and the worldwide reliance on products provided by space-based platforms. The demand for ready access to such services is exceptionally diverse and touches all aspects of government as well as the commercial sector; in some cases, the consumer may not even be aware that a particular product comes from space, which may make even explaining the importance of space protection difficult.[9] This demand and the corresponding need to protect space-based assets is reflected in the NSP, as the dangers to US space systems are manifold, and include threats to satellites themselves such as kinetic attack, cyber attack, and jamming, as well as attacks on ground infrastructure.[10] For the

7. Obama, *National Space Policy of the United States of America*, 7.
8. Ibid., 7.
9. For example, services such as positioning, navigation, and timing from the Global Positioning Satellite (GPS) constellation have become part of the common fabric of everyday life, to include internet timing, banking, mapping, etc.
10. *The National Space Policy of the United States of America* maintains that the US intent is to "increase assurance and resilience of mission-essential functions enabled by commercial, civil,

purposes of this paper, the threat analysis will focus on man-made hazards (vice environmental) that may be posed by potential US competitors or adversaries.

Since the 2007 test of a kinetic kill anti-satellite system by the Chinese military, the threat in space posed by the People's Republic of China has been of growing concern to the United States. China continues to build its national power through rapid economic growth and advances in science and technology, and recent developments in the People's Liberation Army demonstrate a corresponding desire to extend Chinese influence beyond mainland China. Not surprisingly, Chinese military leaders have expressed both their interest in space and their understanding of the US dependence on space-based assets; in fact, "China is developing a multi-dimensional program to improve its capabilities to limit or prevent the use of space-based assets by potential adversaries."[11]

Additionally, the Russian Federation continues to express concern over US space and missile defense initiatives; political-strategic uncertainty in US-Russian relations will likely always be present, and it is often unclear how US actions will be perceived by Russia. In late summer of 2009, General Alexander Zelin, Commander of the Russian Air Force, stated that "Russia's armed forces it must be ready to deter potential aggressors at regional and global levels in peaceful times and to rebuff an armed aggression" and asserted that Russia was developing a new surface-to-air rocket for the purpose of air and space defense[12]. In 2003, the Russians provided Iraq with GPS jammers, which proved moderately successful against some precision

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scientific, and national security spacecraft and supporting infrastructure against disruption, degradation, and destruction, whether from environmental, mechanical, electronic, or hostile causes." Obama, *National Space Policy of the United States of America*, 4.

11. Department of Defense, *Annual Report to Congress Military and Security Developments Involving the People's Republic of China 2010*, (The Pentagon, Washington, DC 2010), 7.

12. Dmitry Solovyov, ed. Robin Pomeroy, "Russia sees U.S. Space Threat, Builds New Rocket," *Reuters.com*, 11 August 2009, http://www.reuters.com/article/idUSTRE57A25Z20090811 (accessed 19 October 2010).

strike weapons[13] and, regardless of success, demanded attention from military planners. Despite numerous changes and upheaval since the end of the Cold War, Russia cannot be ignored: "[s]ince 1999, the United States' share of global GDP has declined, while that of Brazil, Russia, India, and China (BRIC) has increased. By 2014, the International Monetary Fund predicts that BRIC countries will represent more than 27 percent of global GDP, and the United States and the EU will represent less than 20 percent each."[14]

Finally, non-state actors as well as "rogue" states have expressed an interest and a capability to interfere with or deny the use of space systems. Indonesia has jammed a Chinese communications satellite, Iran and Turkey have jammed satellite broadcasts within their countries, and Iran jammed Voice of America broadcasts in 2003.[15] Perhaps more significantly, Iran launched a 600-pound satellite into orbit in February 2009, an accomplishment that took years of preparation and indicates that Iran has developed a multi-stage rocket. Given the current US advantage and commensurate dependence on space power, a rogue state or non-state actor would have little to lose but much to gain by attacking US space systems and space infrastructure; such a state or non-state actor would also not suffer as directly as the US should it take an action that polluted the space environment.

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13. Central Intelligence Agency, CIA Factbook, (2008), https://www.cia.gov/library/publications/the-world factbook/rankorder/2178rank.html, (accessed 22 Sep 10).
14. Abraham Denmark and Dr. James Mulvenon, *Contested Commons: The Future of American Power in a Multipolar World*, (Center for a New American Security, January 2010), 18.
15. Eric Sterner, "Chapter IV: Beyond the Stalemate in the Space Commons," ed. Abraham Denmark and Dr. James Mulvenon, *Contested Commons: The Future of American Power in a Multipolar World*, (Center for a New American Security, January 2010), 118.

This complex and varied threat environment is compounded by the diversity of national and international agencies with a legitimate stake in space. A cursory glance at a depiction of the US National Security Space Community presented by Dr. Peter Hays of the National Security Space Office (Figure 1)[16] shows the diversity of agencies that both comprise and affect National Security Space (NSS)[17]; it can be seen that this community extends well beyond the NSS core

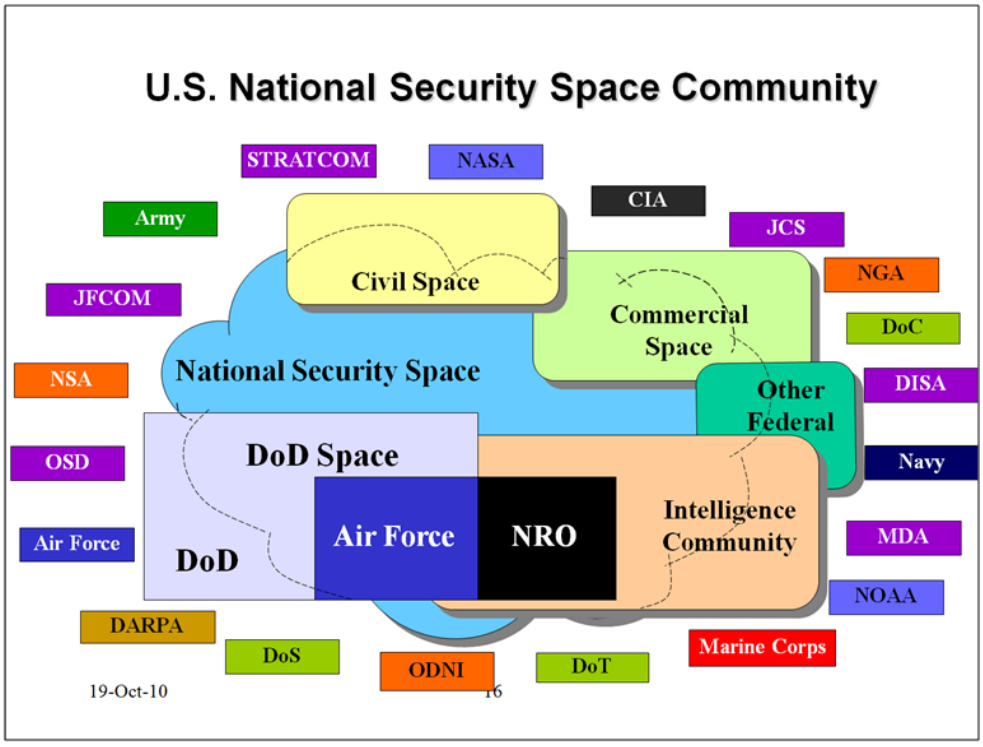


Figure 1 . U.S. National Security Space Community. (Reprinted from Dr. Peter Hays, "Space Security: Overview and Issues" (lecture, Air War College, Maxwell AFB, AL, 17 August 2010).

members (DoD and the IC), and includes entities such as civil space agencies (e.g., NASA and NOAA) and the commercial sector. Each of these stakeholders has its own vested interests, roles, and equities in space, many of which may not align; however, the products and services

16. Used with permission of Dr. Peter Hays, e-mail to author …..
17. Based on the NSP, National Security Space is defined for the purposes of this paper as the Department of Defense (DoD) and Intelligence Community (IC).

that they produce are interwoven into all aspects of the US government and its citizenry. The NSS community is both a provider and a voracious user of space-based systems and the products these systems provide and, over the previous 20 years, this demand has increased dramatically, resulting in a dependence on force enhancement capabilities such as global positioning and satellite communications (SATCOM). Considering the use of precision guided munitions (which rely on GPS signals) it can be seen that 92% of the weapons employed during Desert Storm were unguided, while only 32% of the weapons employed during the air campaign portion of Operation Iraqi Freedom were unguided (Figure 2)[18]. Additionally, growth and reliance in other

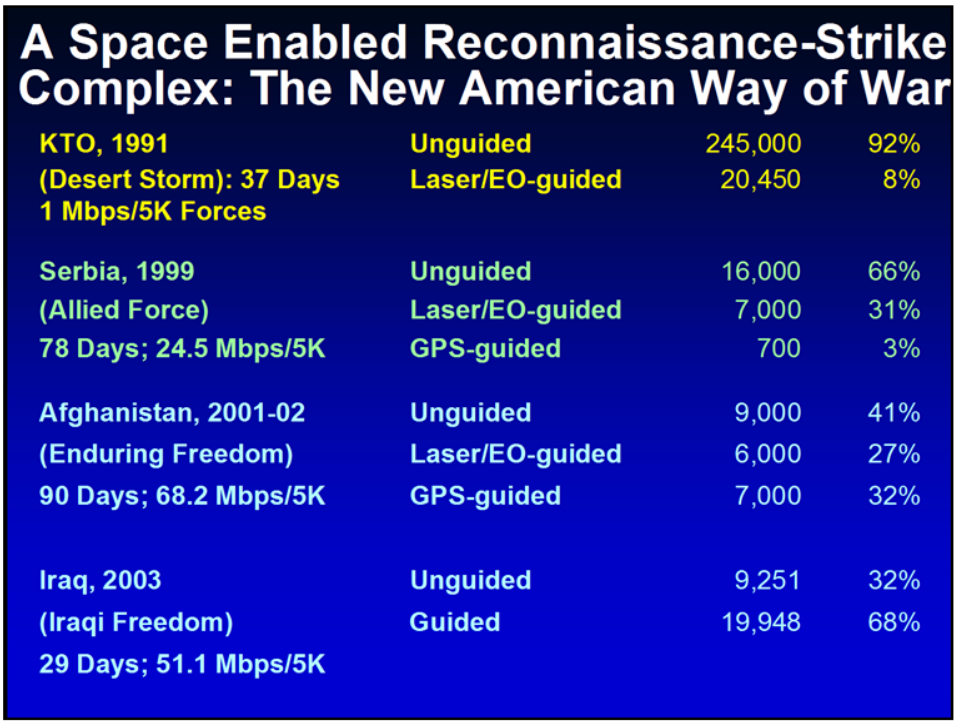
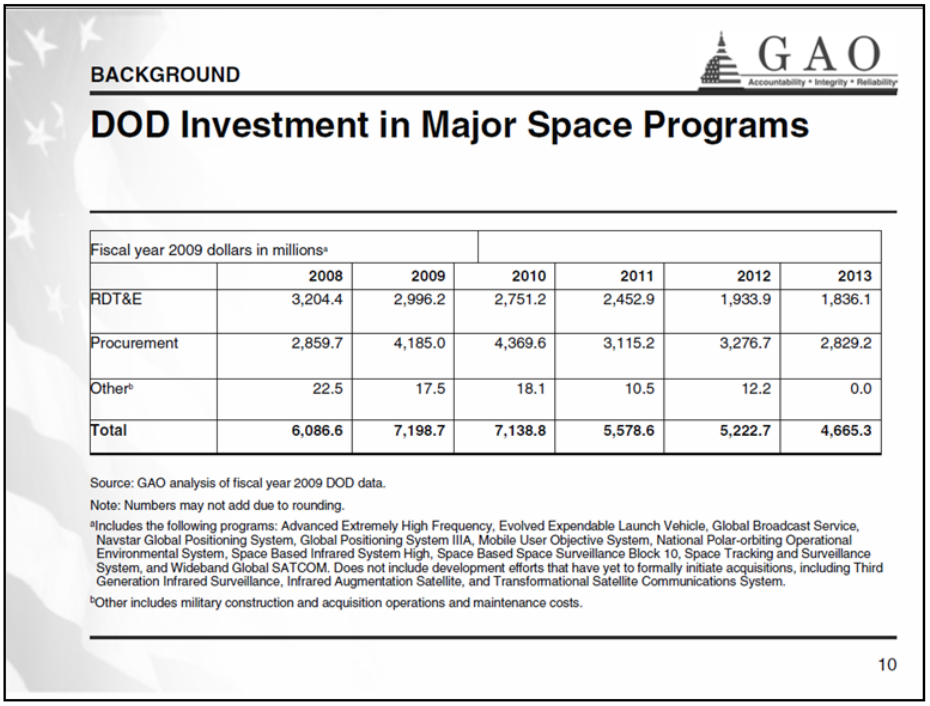


Figure 2 . Comparison of Use of Unguided versus Guided Weapons. (Reprinted from Dr. Peter Hays, "Space Security: Overview and Issues" (lecture, Air War College, Maxwell AFB, AL, 17 August 2010).

18. Used with the permission of Dr. Peter Hays. Dr. Peter Hays to the author, e-mail, 25 January 2011.

areas, such as SATCOM and missile warning, are only expected to increase in the coming years, and the DoD is expected to continue to invest billions of dollars in major space programs well into the foreseeable future (Figure 3).

In the civil sector, the NSP also directs the NASA Administrator and the Secretaries of Commerce and the Interior to undertake a number of tasks in space, to include maintaining the



BACKGROUND

GAO
Accountability * Integrity * Reliability

DOD Investment in Major Space Programs

Fiscal year 2009 dollars in millions[a]	2008	2009	2010	2011	2012	2013
RDT&E	3,204.4	2,996.2	2,751.2	2,452.9	1,933.9	1,836.1
Procurement	2,859.7	4,185.0	4,369.6	3,115.2	3,276.7	2,829.2
Other[b]	22.5	17.5	18.1	10.5	12.2	0.0
Total	**6,086.6**	**7,198.7**	**7,138.8**	**5,578.6**	**5,222.7**	**4,665.3**

Source: GAO analysis of fiscal year 2009 DOD data.

Note: Numbers may not add due to rounding.

[a]Includes the following programs: Advanced Extremely High Frequency, Evolved Expendable Launch Vehicle, Global Broadcast Service, Navstar Global Positioning System, Global Positioning System IIIA, Mobile User Objective System, National Polar-orbiting Operational Environmental System, Space Based Infrared System High, Space Based Space Surveillance Block 10, Space Tracking and Surveillance System, and Wideband Global SATCOM. Does not include development efforts that have yet to formally initiate acquisitions, including Third Generation Infrared Surveillance, Infrared Augmentation Satellite, and Transformational Satellite Communications System.

[b]Other includes military construction and acquisition operations and maintenance costs.

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Figure 3. DoD Investment in Major Space Programs. Reprinted from United States Government Accountability Office, "Briefing on Commercial and Department of Defense Space System Requirements and Acquisition Practices," (Washington, DC, 14 January 2010), http://www.gao.gov/new.items/d10315r.pdf (accessed 8 December 2010).

International Space Station through 2020 and beyond, maintaining a program for operational land remote sensing observations, and (in consonance with the Secretary of Defense) ensuring uninterrupted, operational polar-orbiting environmental satellite observations.[19] These efforts will play a significant role in research and development and will aid in assessing climate change,

19. Obama, *National Space Policy of the United States of America*, 12.

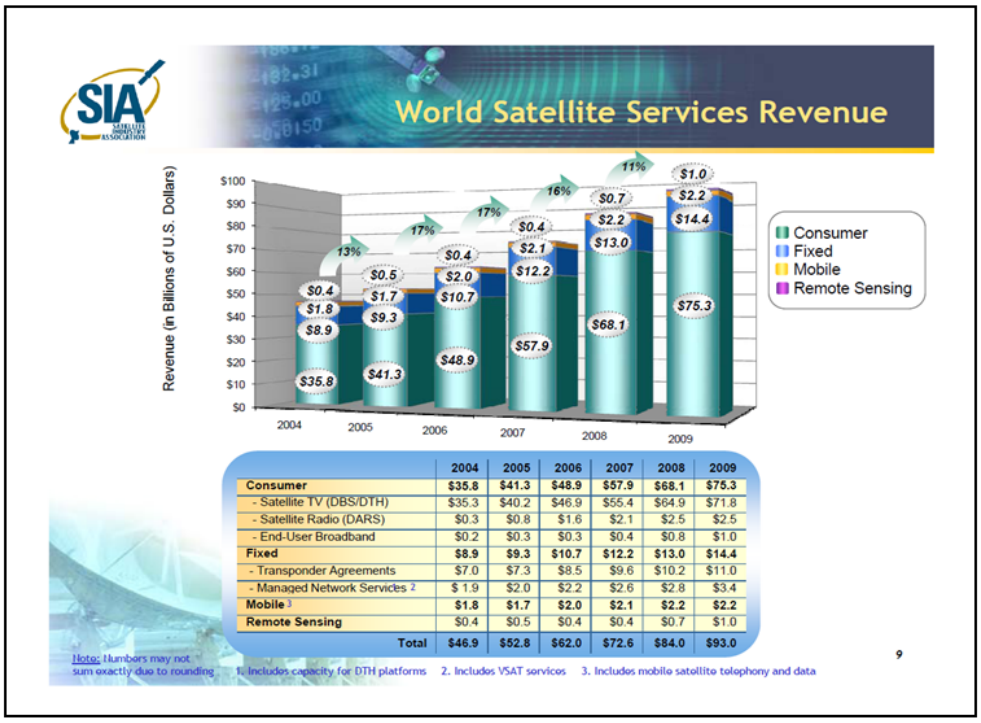
predicting weather, and providing timely information in support of disaster relief operations, all functions that are of vital interest to US, state, and local governments as well as the population writ large. In order to carry out this ambitious directive, NASA has seen a significant budget increase, including a top line increase of $6.0 billion over 5 years (FY 2011-15) compared to the FY 2010 budget, for a total of $100 billion over five years. Given this budget increase, NASA intends to pursue new approaches to space exploration, conduct research and development on heavy-lift and propulsion technologies, seek increased utilization of the International Space Station, and accelerate the next wave of climate change research and observations spacecraft[20] – these goals are clearly linked to the NSP and the significant monetary investment in NASA programs is a clear indicator of the national importance attached to these initiatives.

This growth has been matched by unprecedented investment in space systems and space products in the commercial sector, as a growing number of companies have developed both satellites and terrestrial systems that depend on space products. This growth has not been confined to the United States, as the international space market has swelled in recent years, with advances in space-based communications, weather monitoring, and ISR, as well as commercial space launch. Industry has clearly seen a demand and a market for satellite manufacturing and services as well as an increased desire for commercial launch capacity; in the satellite services sector alone, world revenue nearly doubled from 2004 to 2009, growing from $46.9 billion to $93.0 billion during this period (Figure 4) [21]. Additionally, satellite services revenue grew

20. National Aeronautics and Space Administration, "NASA Fiscal Year 2011 Budget Estimates," http://www.nasa.gov/pdf/420990main_FY_201_%20Budget_Overview_1_Feb_2010.pdf, (accessed 8 December 2010).

21. Futron Corporation, sponsored by the Satellite Industry Association, has collected satellite industry data in a series of annual studies that represent information from four satellite industry segments: satellite services, satellite manufacturing, launch industry, and ground equipment. A

11%from 2008 to 2009, and satellite manufacturing revenue increased by nearly one-third between 2008 and 2009, as greater numbers of high-value spacecraft were completed and launched.[22]



	2004	2005	2006	2007	2008	2009
Consumer	**$35.8**	**$41.3**	**$48.9**	**$57.9**	**$68.1**	**$75.3**
- Satellite TV (DBS/DTH)	$35.3	$40.2	$46.9	$55.4	$64.9	$71.8
- Satellite Radio (DARS)	$0.3	$0.8	$1.6	$2.1	$2.5	$2.5
- End-User Broadband	$0.2	$0.3	$0.3	$0.4	$0.8	$1.0
Fixed	**$8.9**	**$9.3**	**$10.7**	**$12.2**	**$13.0**	**$14.4**
- Transponder Agreements	$7.0	$7.3	$8.5	$9.6	$10.2	$11.0
- Managed Network Services [2]	$ 1.9	$2.0	$2.2	$2.6	$2.8	$3.4
Mobile [3]	**$1.8**	**$1.7**	**$2.0**	**$2.1**	**$2.2**	**$2.2**
Remote Sensing	$0.4	$0.5	$0.4	$0.4	$0.7	$1.0
Total	**$46.9**	**$52.8**	**$62.0**	**$72.6**	**$84.0**	**$93.0**

Figure 4. World Satellite Service Revenue 2004-09. Reprinted from Futron Corporation (prepared for Satellite Industry Association), "State of the Satellite Industry Report June 2010," http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport(Final).pdf (accessed 25 Sep 2010), 6.

The United States has moved from a simple reliance on space-based platforms to one of dependence; the capital investment in the NSS, civil, and commercial space sectors is clear evidence of the unique and valuable nature of products from space. Given the threat posed by

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review of data from 2009 shows that "[w]orld satellite industry revenues posted average annual growth of 11.7% for the period from 2004 through 2009."[21] Futron Corporation (prepared for Satellite Industry Association), "State of the Satellite Industry Report June 2010," http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport(Final).pdf (accessed 25 Sep 2010), 6.

22. Ibid., 22.

near peer adversaries and smaller actors, the United States must give thought to methods for defending its equities in space.

THE UNITED STATES' POSTURE IN SPACE – COMPETING VISIONS

As discussed in the introduction, there has been significant attention given to the government/military role in space, frequently dwelling on the pros and cons of weaponizing space and whether or not the United States should attempt to gain dominance in space. This debate has a number of nuances, including fielding and use of anti-satellite weapons, development of space-based weapons intended for use against terrestrial targets, and even employment of nuclear weapons in and from space; likewise, there is a strong constituency which advocates that space should be a sanctuary and opposes any action that could lead to further militarization or the weaponization of space. The subsequent paragraphs will provide a brief overview of two of the most common positions regarding strategies for the government/military posture in space: those who advocate for the immediate weaponization of space and those who believe that space should be a sanctuary protected by international treaties.[23]

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23. A third possibility beyond the scope of this paper is "hedging" in which the United States would focus on reducing vulnerabilities in space and attempt to deter other nations from weaponizing space. In such a construct, the United States would develop counterspace weapons as a deterrence against other nations that might pursue such weapons and as a response to an attack in space should one occur. Krepon and Clary state "[d]eterrence would be served by the certain knowledge of potential adversaries that negative initiatives on their part would be met by prompt and effective rejoinders by the United States. Thus, a hedging strategy requires readiness to respond purposefully in the event of unwelcome or hostile activities in space by another nation. No aspect of a space assurance posture is more important." Such a policy seems to be a "middle of the road" approach; those who advocate weaponization of space would receive funding for counterspace programs and would be pursue such systems. Those who desire a space sanctuary would embrace the fact that such systems would not be employed while gaining additional time to resist the weaponization of space. While initially appealing, such an approach would face all the challenges inherent in space operations (cost, technological hurdles, and launch) yet could be perceived as providing no tangible service to consumers; there would likely be a deterrence benefit of embarking on such a course of action that could offer advantages at the national/strategic level, but it would be difficult to measure or prove "deterrence". As such, it is

One of the leading researchers advocating the immediate weaponization of space is Dr. Everett C. Dolman, who has written extensively on the subject. Dolman believes that the US military has undergone a transformation and changed from a space-supported force to a space-enabled force; he indicates that the purpose of such military power is to serve as an extension of policy, providing political decision-makers a tool that allows the state to achieve its national objectives.[24] Accordingly, he draws the conclusion that "if military space is to achieve its purpose, it must likewise be prepared to project violence from and into space"[25] and that if the USAF is to be tasked with protecting space assets, it must be allowed to weaponize space.[26] The appeal of such arguments is based on the extraordinary risk the United States would accept should it choose not to weaponize space and subsequently fall victim to an attack in or from space. The results of such an attack could be nearly catastrophic for both the nation's military and its economy and, as such, have a dramatic effect on the world's balance of power – given this potential, one could argue that the United States has a duty to weaponize space and anything less would constitute a reckless abandonment of responsibility. Conversely, one can argue that Dolman's approach would upset an existing tacit balance – the "strategic restraint" that some authors contend exists in space strategy. For example, in his book *The Politics of Space*

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difficult to imagine investing what could be a significant portion of the DoD space budget in the development of systems that will not provide an immediate, tangible service to the warfighter; given the demand for satellite communications, ISR, missile warning, etc., it is unlikely that there would be many advocates for a system that would be developed but not deployed operationally. Additionally, advocates of such a strategy do not consider the challenges of employing these systems on short notice during crises, or the difficulties of integrating and synchronizing such systems with the theater combatant commanders' operational plans post-crisis.

24. Dr. Everett C. Dolman, "Astropolitics and Astropolitik: Strategy and Space Deployment," in *Harnessing the Heavens*, ed. Paul G. Gillespie and Grant T. Weller (Chicago, IL: Imprint Publications, 2008), 116.
25. Ibid., p. 116
26. Ibid., 111.

Security: Strategic Restraint and the Pursuit of National Interests, James Clay Moltz argues that acceptable "norms" of space behavior have been established, and that these norms have resulted from a general understanding of the need for a safe space environment, to the ultimate benefit of all nations.[27] Proponents of Moltz's theory argue that Dolman's path would upset these norms and risk an arms race in space to the detriment of the world.

At the opposite end of the spectrum are those who advocate for a space sanctuary, a philosophy that has a wide-ranging constituency despite variances in the precise definition of "sanctuary." Perhaps the best description of space sanctuary doctrine is provided by Lupton, who offers the following: "The primary value of space forces results from their ability to reduce the likelihood of catastrophic nuclear war. Using space for military purposes other than the deterrent functions may cause wars in space. These wars may result in loss of the primary functions, with destabilizing effects. The risk of losing the primary functions cannot be worth the benefit gained. Therefore, space must be a sanctuary from military systems."[28] Advocates of this strategy believe that establishing limits on the weaponization of space would prevent a space arms race, ensure that space does not become a battlefield, and would ensure freedom of access to and through space for all space-faring nations. One can argue that such a sanctuary strategy has been the case (with few exceptions) since the dawn of space operations and has worked successfully; it follows then that the United States should be a world leader by refraining from engaging in offensive space control activities.[29] While adopting such a position is idyllic, an

27. James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, California: Stanford University Press, 2008), 65.
28. Lt Col (retired) David E. Lupton, *On Space Warfare: A Space Power Doctrine*, Airpower Research Institute (Maxwell AFB, AL: Air University Press, June 1998), 43.
29. Offensive space control is defined as those operations to prevent an adversary's hostile use of US/third party space capabilities and services or negate (disrupt, deny, degrade,

administration that adopted such a tack would undoubtedly face several challenges and accept significant risk. First, while the argument that space needs to remain a sanctuary used only for detection of nuclear weapons is logical in a limited sense, it fails to describe how the United States is to monitor others' activity in space[30]; in the same manner that missile warning satellites have deterred the first use of nuclear weapons by detecting and reporting missile launches, some sort of system for detecting and attributing attacks on space systems would be required. Second, it neglects programs already underway in other countries to enable attacks on US space systems. Finally, the 2010 NSP implies that the United States has an obligation to protect US equities in space, much in the same manner that it does on the sea, in the air, and on land; preventing all military activity in space (outside of missile warning) will make this an exceptionally difficult if not impossible mission.

The preceding paragraphs have briefly described two competing space posture strategies at each end of the spectrum and outline some of advantages and disadvantages of each concept. The following section will discuss possible solutions that would allow the United States to protect its equities in space and ensure the "cost effective survivability" of space systems as directed by the NSP.

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deceive, or destroy) an adversary's space capabilities. Defensive space control is defined as Operations conducted to preserve the ability to exploit space capabilities via active and passive actions, while protecting friendly space capabilities from attack, interference, or unintentional hazards. (*Joint Publication (JP) 1-02, DoD Dictionary of Military and Associated Terms* (12 April 2001 (As Amended Through 30 September 2010)).

30. While beyond the scope of this paper, methods would also need to be developed to monitor and attribute offensive activities against space systems that originate from terrestrial sources (such as directed energy weapons or jammers). In order to ensure space is maintained as a sanctuary and to deter attacks on space systems, the United States would need to develop a comprehensive architecture that can determine the source of an attack on a space system, discriminate between and attack and an anomaly, and assess the intent of such an attack from both terrestrial and space-based systems.

POSSIBLE SOLUTIONS FOR PROTECTING US INTERESTS IN SPACE

Joint Publication 1-02 defines full-spectrum superiority as "the cumulative effect of dominance in the air, land, maritime, and space domains and information environment that permits the conduct of joint operations without effective opposition or prohibitive interference";[31] from this definition, it can be concluded that achieving space dominance would require the ability to control space to a degree that would prevent any opposition or interference by adversaries. Such an approach, if adopted, would entail the immediate acquisition and employment of weapon and targeting systems that could be used to deceive, disrupt, deny, degrade, and/or destroy an adversary's space and/or counterspace capabilities. These systems (or system of systems), when used in support of a doctrine of space dominance, would provide freedom of action in space for the United States while denying the same to an adversary. At the tactical and operational levels of war, space dominance would help the United States to create a turbulent, chaotic situation for its enemies, thereby allowing it to impose its will on the enemy in support of both national and military objectives. At the strategic level, the fielding of space weapons and subsequent space dominance could possibly serve as a deterrent to other nations. Everett Dolman predicts that "if the United States were willing to deploy and use a military space force that maintained effective control of space, and did so in a way that was perceived as tough, non-arbitrary, and efficient, such an action would serve to discourage competing states from fielding opposing systems. Should the United States use its advantage to police the heavens and allow unhindered peaceful use of space by any and all nations for economic and scientific development, over time its control of low-Earth orbit could be viewed as a global asset

31. JP 1-02, *DoD Dictionary of Military and Associated Terms*, 188.

and a public good."[32] Conversely, those who oppose attempts to achieve space dominance argue that such efforts would result in a space arms race, and that other nations would view "American initiatives to weaponize space as adjuncts to a US military doctrine of preemption and preventive war."[33] Additionally, US space-based weapons would likely be of little use against rogue states or even rising space-faring nations whose dependence on space is less than that of the United States.

Another possible solution is for the United States to undertake an effort to strengthen international treaties; proponents of such an approach argue that strict prohibitions against weapons in space would strengthen international norms and rely on international cooperation to assure access to space. International treaties to prohibit flight-testing and deployment of space weapons could both reinforce the notion of space as a global commons depended on by all nations and demonstrate the international importance of systems like GPS. Additionally, US involvement in negotiating such treaties would strengthen international institutions such as the United Nations, define unacceptable actions in space, and, should such prohibited actions take place, allow parties to have firm legal footing upon which to take action against treaty violators; advocates of such international treaties also point to efforts made by the Chinese and Russians to ban space weapons as evidence that near-peer nations are willing to engage in such negotiations and that, in fact, the United States is actually proving to be an obstacle to the ratification of such an expanded treaty.[34]

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32. Everett C. Dolman, "A Debate About Weapons in Space: For U.S. Military Transformation and Weapons in Space," *SAIS Review*, 26, no. 1 (Winter-Spring 2006), 172.
33. Krepon, *Space Assurance or Space Dominance? The Case Against Weaponizing Space*, 62.
34. Nick Cumming-Bruce, "U.N. Weighs a Ban on Weapons in Space, but U.S. Still Objects," *New York Times*, 13 Feb 08, http://www.nytimes.com/2008/02/13/world/europe/13arms.html, (accessed 5 December 2010).

Unfortunately, committing the United States to such treaties also has negative ramifications and may actually limit options for protecting US equities in space, squandering the current advantage the United States has in space. Additionally, signatories could secretly pursue space weapons while under the protection of such international treaties, buying themselves time to close the technology gap with the United States, and then withdraw from these treaties when it is to their advantage to do so. Finally, as with any treaty, verification to ensure compliance would provide significant challenges, especially in the space domain – current limits to SSA make it both difficult to precisely assess what is being launched into space and what its true purpose is or could be; additionally, the legitimate secrecy that surrounds many launches (to protect technology advances and satellite capabilities) would further hinder the ability to verify adherence to treaty standards.

The final solution that will be considered is to undertake an effort to dramatically improve SSA as an enabler to protect and prevent attacks against space systems. In addition to providing intelligence to the joint force commander, improved SSA could be used for a variety of other purposes, to include safety of flight, treaty verification, and attribution of hostile actions in space to the appropriate party. These benefits would then allow the United States to take appropriate action to protect satellites in situations where an attack or collision is anticipated or, in cases of hostile activity, to take unilateral action or bring international pressure to bear on the protagonist to halt the undesired activity. That said, the benefits of developing improved SSA are nothing new, and JP 3-14 clearly explains the advantages of achieving the same; however, investment in SSA as well as systems to protect satellites has traditionally not fared well when competing for limited procurement monies – it is difficult to justify a need for systems that

provide small tangible benefit to the joint force commander, especially when compared to the demand for traditional forms of space force enhancement.

The preceding paragraphs present just a few options for protecting US interests in space, and there are countless nuanced combinations of these solutions that would potentially increase security in space. The next section of this paper will provide findings and a recommendation that will incorporate some aspects of these solutions in order to address the tasking assigned by the president in the NSP.

FINDINGS AND RECOMMENDATIONS

This paper opened with the president's NSP tasking to the Secretary of Defense and the Director of National Intelligence to "ensure [the] cost-effective survivability of space capabilities"; this discussion was then followed by a synopsis of the burgeoning threats to US space interests that make survivability an essential task. It was then demonstrated that this very complex undertaking is made more difficult by the variety of stakeholders who have an interest in space as well as the array of competing solutions that have been presented to aid in defining a US strategy for space.

Based on this review, four findings arise that must be considered when developing solutions to ensure the cost-effective survivability of space capabilities. First, there is no agency that has the authority to the direct the actions of NSS, commercial, and civil space stakeholders to oversee the protection of space systems and the space environment. Second, the United States is more dependent on space systems than any other nation, and space systems are now key enablers for all elements of US national power (diplomacy, information, military, and economic); however, there is no requirement for building protection/detection measures into space systems. Third, the use of space for military means is a highly contentious issue with a wide variety of opinions, each of which has both merit and limitations. Fourth, SSA continues to develop, but it is not robust enough to support any of the possible solutions identified earlier in this paper.

Each of these findings represents a complex problem, but a common theme that links them is the need for a focused effort to protect space systems without creating an arms race in

space. This paper recommends three actions be taken to create such a focused effort: pass legislation assigning USSTRATCOM as the responsible agency for space protection, develop and field a terrestrial and space-based surveillance architecture, and develop a system for sharing SSA information via both classified and unclassified networks.

First, USSTRATCOM should be appointed in law as the responsible agency for the protection of US space systems (NSS, civil, and commercial).[35] Much like the United States Coast Guard (USCG) is the military service with responsibility for maritime safety, USSTRATCOM should have the authority to dictate minimum protection requirements for all US satellite systems, serve as a repository of data for all space systems, conduct inspections of space systems prior to launch, and monitor what is occurring in space.[36] If the US government intends to treat space systems as sovereign US territory[37], the US government must set and

35. USSTRATCOM's current mission is "to deter attacks on U.S. vital interests, to ensure U.S. freedom of action in space and cyberspace, to deliver integrated kinetic and non-kinetic effects to include nuclear and information operations in support of U.S. Joint Force Commander operations, to synchronize global missile defense plans and operations, to synchronize regional combating of weapons of mass destruction plans, to provide integrated surveillance and reconnaissance allocation recommendations to the SECDEF, and to advocate for capabilities as assigned." United States Strategic Command, "Mission Statement," http://www.stratcom.mil/ (accessed 12 December 2010).

36. The USCG Marine Safety Performance Plan states that "[b]y preventing marine casualties, [the Coast Guard] also protect[s] the marine environment from oil spills and the introduction of other harmful substances, and strengthen[s] the economy by minimizing property loss and disruptions to maritime commerce;" much as the Coast Guard protects US interests in the global commons of the ocean, USSTRATCOM should perform similar tasks in the global commons of space. *U.S. Coast Guard Marine Safety Performance Plan FY 2009-2014*, November 2008, http://www.uscg.mil/hq/cg5/cg54/docs/MSPerformancePlan.pdf, (accessed 8 December 2010).

37. The 2010 NSP offers the following as one of its core principles: "[a]s established in international law, there shall be no national claims of sovereignty over outer space or any celestial bodies. The United States considers the space systems of all nations to have the rights of passage through, and conduct of operations in, space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an *infringement of a nation's rights*" (emphasis added). Obama, *National Space Policy of the United States of America*, 3.

enforce standards for protection of US space systems and assign an agency to ensure that these measures are enforced.

Second, the United States should make developing and fielding a terrestrial and space-based surveillance architecture a national priority. Making such an architecture a reality would support any of the possible strategies proposed in the preceding section of this paper, as space surveillance will support space being protected as a sanctuary, will be required for verification of any space treaties, and would be used to provide intelligence and targeting information should the United States ultimately elect to pursue a policy of space dominance. Making a comprehensive surveillance architecture a national priority would also focus US spending precedence on only one aspect of space control (possibly postponing and/or halting development of space-based weapons as a cost offset), thereby ensuring unity of effort toward a common goal.

Finally, the United States should develop/refine[38] both a classified and unclassified means of sharing SSA data in a user-friendly, internet-based format. As mentioned previously, SSA is fundamental to implementing the variety of solutions available to current and future administrations for protecting US interests in space. Further, once such a means of sharing is developed, the United States would have the capability to provide unclassified information to the international community; this would likely serve as a confidence building measure and possibly spark previously unimagined uses for this information. Sharing this data could also serve as a deterrent to other nations, possibly preventing conflict in space; if the United States demonstrates an ability to attribute a hostile action in space or against a space system and, upon attribution of

38. See Smitham, Lt Col Matthew, "The Need For A Global Space-Traffic-Control Service: An Opportunity for US Leadership" (Professional Studies Paper, Air War College, Maxwell, AFB, AL, 2010) for additional discussion on global SSA.

such an act, promises retaliation[39], it may be possible to deter other nations from attacking US satellites. If deterrence fails, the United States would have strong justification to use all aspects of its national power to retaliate, and such retaliation measures would not need to be a "response in kind"; in other words, the United States would not have to have space weapons on orbit to retaliate, it could use economic sanctions, international courts, or execute a conventional land, sea, air, or cyber attack on the aggressor nation. As a final point, the development of a comprehensive SSA picture would also allow the development of a land, sea, air, and space common operational picture (COP), creating a multi-dimensional COP that would be used by joint force commanders and their component commanders to achieve comprehensive situational awareness.

In conclusion, the United States cannot be caught in a situation where it is not prepared for an attack against its space systems – they are too critical, too expensive, and too much a part of national power to fail to take the initiative to protect them – "[a]ll actions in war, regardless of the level, are based upon either taking the initiative or reacting in response to the opponent. By taking the initiative, we dictate the terms of the conflict and force the enemy to meet us on our terms. The initiative allows us to pursue some positive aim even if only to preempt an enemy initiative. It is through the initiative that we seek to impose our will on the enemy."[40] Debate, analysis, and policy goals are important aspects of decision-making, but the time has come to make a commitment to seizing the initiative and taking decisive action to protect US interests in space.

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39. According to the 2010 NSP, "[t]he United States will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of self-defense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, *if deterrence fails, defeat efforts to attack them"* (emphasis added). Obama, *National Space Policy of the United States of America*, 3.

40. Marine Corps Doctrinal Publication (MCDP) 1, *Warfighting*, 20 June 1997, 32.

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